SYNOPSIS

Ph.D in Botany

BIOCONVERSION OF PADDY AND COFFEE HUSKS AS ORGANIC MANURE AND ITS EFFECT ON PLANT GROWTH AND SOIL FERTILITY

By

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INTRODUCTION

Agriculture is the art and science of cultivating the soil by growing crops and raising livestock. It includes the preparation of plant and animal products for people to use and provides most of the world's food and fabrics. Agriculture is defined as the science or practice of farming which include growing crop by cultivation or rearing of animal. People cannot survive without productive agriculture. From ancient times, man used various kinds of vegetable manure, dung, urine of animals, chicken manure even dead and decaying animal matter, green manure crops and wood ashes to enrich the soil and the crops in agriculture. So, the holistic production management system in agriculture is organic agriculture which promotes and enhances agro ecosystem health including biodiversity, biological cycles and soil biological activity.

Continuous use of organic manure will result in sustainable agriculture, safe food, good nutrition, animal welfare and sustainable ecosystems (Sivasankari, 2016). India holds the record for second-largest agricultural land in the world, with around 60% of rural Indian households making their living from agriculture. Agriculture plays a vital role in India's economy with 54.6 % of the total workforce engaged in agriculture and allied sector activities. India also produces about 600 million tonnes of crop residue each year, with the majority being permitted to degrade naturally or burned on the spot as reported by the Intensive Agriculture Survey, (2022) of the Indian Government. Organic agriculture is now emerging as a sustainable alternative to traditional agriculture using environmental friendly strategies such as the application of organic fertilizers from plant, animal waste and pesticides based on plant extracts and microbial consortia (Duran-Lara *et al*., 2020).

Paddy and coffee husk can be classified as agro-industrial wastes due to their origin from agricultural processes and their potential for industrial applications. These husks are by-products of rice and coffee production respectively and are generated during the processing of these commodities. The Intensive Agriculture survey, (2022) of Indian Government reported that paddy is the second most widely grown cereal crop and staple food for more than half of the world's population. India has the largest paddy growing area (43.80 Million hectares) in the world but contributes to less than a quarter of global production (177.65 Million tons in 2019 with consumption of 106.5 million tons per year). Rice accounts for more than 40% of the food grain production of the country and has the highest export volume of rice worldwide

at 15.5 million metric tons as of 2020-2021. Ministry of Agriculture and Farmers press release reported that total production of rice during 2022 – 23 is estimated at 1308.37 lakh tonnes. It is higher by 13.65 lakh tonnes as compared to previous year.

Paddy husk is the byproduct of the rice milling industries, therefore agroindustrial residue are abundantly available in various paddy producing countries. Approximately 140 million tonnes of paddy husk is produced worldwide annually. It is hard covering of rice grains and composed of cellulose, lignin and hemicelluloses due to this reason the paddy husk is either burnt or dumped as waste while some of the husk is converted to use for cattle feed, when it is burnt, it causes environmental and health problems. Recycling of such waste can be beneficial to the environment and this agro industrial waste can be used to produce useful agricultural soil input (Mohamed *et al*., 2015; Britanica, 2023).

Coffee (*Coffea arabica* L.) is an important export product that has substantial foreign exchange for the producing countries. In India, coffee is cultivated mainly in southern states of Karnataka (72%), Kerala (20%) and Tamil Nadu (7%) (Velmourougane and Raphael, 2012). Ministry of Commerce and Industry press release reported that total production of coffee during 2021-22 is estimated at 4.16 lakh tonnes. India was 5^{th} largest exporter of coffee in the world with a share of about 6% of global coffee exports. It is one of the top commodities produced, commercialized worldwide and the processing of coffee generates significant amount of coffee pulp and cherry husk as agricultural waste ranging from 30% to 50%. Coffee husk is the dried husk of the coffee cherry or coffee fruit and the process includes dehusking of the dried fruit by separating the dried husk from the coffee seed. Coffee husks and pulp are the major solid residues obtained during processing of coffee for which there are no current profitable uses and their adequate disposal constitutes a major environmental problem.

Coffee processing units that are located in coffee growing areas create threat to the environment because of unsafe disposal of coffee pulp, husk and effluents leading to pollution of water and land around the processing units. India produces approximately 10 million tonnes of coffee husk annually. Large potential are noted by recycling of pulp and husk that can be composted and used as manure for several crops (Sekhar *et al*., 2014; Oliveira and Franca, 2015). Resource recovered through composting is one of the best approaches for obtaining nutrient and organic-rich biowaste (Waqas *et al*., 2018).

Agro Industrial wastes like paddy and coffee husks when burnt on the road sides or in the fields emit toxic smoke and disturb the environment which can be avoided and nutrients can be obtained through the biocomposting. Most of the people think compost as a source of nutrients to add to the soil. However, its contribution with diverse set of microorganisms combined with high levels of organic matter may offer even more significant benefits (Shilev *et al*., 2007). As part of organic farming, conversion of agricultural wastes into biocomposts will reduce the risk of chemical fertilizers which take an important role in conditioning the soil as the main source of nutrients and it is also an excellent option for reducing environmental threats.

Organic farming is helpful for the production of safe food at low cost. There are different components in organic manure preparations viz. green manures, biocomposting, vermicomposting with various wastes of agriculture and industries. Recycling of organic waste is an attractive method that is used as soil conditioner for waste management (Bhat *et al*., 2017).

Vermicompost is an essential part of the broad system of waste management in organic farming because recycling of waste using eco-friendly agricultural techniques by introducing earthworm species is also an alternative to chemical fertilizers. Organic farming is a low-cost technology and it provides the soil with sufficient micro and macro nutrients required for the growth of the plants (Hand *et al*., 1988; El Jawaher, 2020).

The efficacy of the compost was conducted on four test plants i.e., Moth bean (*Vigna aconitifolia* (Jacq) Marechal) Var. RMO - 40, Black gram (*Vigna mungo* (L.) Hepper) Var. CO - 6, Fenugreek (*Trigonella foenum-graecum* L.) Var. Lam Selection - 1 and Kalmegh (*Andrographis paniculata* (Burm.f.) Wall. ex Nees) Var. CIM - Megha.

Moth bean is one of the most drought resistant crop grows in semi arid and arid regions of Gujarat, Karnataka, Rajasthan, Maharashtra and Haryana and its yield is much less as compared to other legume crops (Sipai *et al.*, 2018). Black gram is an important pulse crop which grows throughout India for it is the major source of protein hence a lot of efforts are being put to enhance the crop. (Gomathinayagam *et al*., 2021). Among the entire legumes black gram is an important crop which is grown in India. It contains 24% of protein, 60% of carbohydrate and 1.3% of fat. It is commonly called as ‘urd’ or ‘urd bean’ through its ability it fixes the atmospheric nitrogen and improves the soil fertility with its root nodules (Shekhawat

et al., 2018). The increasing of new diseases and their inefficiency as well as unavailability of modern drugs have now made everyone to search for new alternative medicines from the plant source and protect them (Uthirapandi *et al*., 2021). According to Akbar, (2011) fenugreek seeds are rich in proteins with tryptophan, lysine, carbohydrates, fixed oils (lipids), alkaloids, trigonelline, choline, gentianine, carpaine, free amino acids, calcium, iron, vitamins B, A and C. It has been used for medicinal purposes since ancient times and being used by pharmaceutical industry.

Kalmegh (*Andrographis paniculata* (Burm.f.) Wall. ex Nees) contains many bioactive compounds, including terpenoids, flavonoids, alkaloids, phenols, glucosides and lactones. Due to this, the plant got a broad spectrum of pharmacological applications and being used in commercial formulations (Raina *et al*., 2013; Yadav and Baquer, 2014). Mostly the aerial parts of the plant like leaves and stem are used as a traditional medicine because they contain larger quantities of major active metabolites (Dua *et al*., 2004).

Research Gap of the Present Study

The current research on the bioconversion of paddy and coffee husk wastes has made significant progress in exploring the utilization of these agro-industrial residues for various applications such as biofuels and industrial applications like paper and packaging industries. However, there are still some research gaps that need to be addressed:

- Optimization of bioconversion processes: Further research is needed to optimize the bioconversion processes of paddy and coffee husk wastes to enhance efficiency, yield, and cost-effectiveness.
- Exploration of novel applications: There is a gap in exploring novel applications of the bio converted products from paddy and coffee husk wastes, such as their potential use in enhancing soil fertility, plant growth and overall agricultural sustainability (Alexandri *et al*., 2020; Takala, 2021)

The present work reveals the importance of using paddy and coffee husk biocompost as an alternative source for chemical fertilizer. Experimental work has been conducted to observe the effect of paddy and coffee husk biocompost and its efficiency on the vegetative, biochemical, yield, phytochemical analysis, antioxidant and antibacterial activity of four test plants. Based on the above reported information the present study is designed:

The Objectives of the study are as follows

- Preparation of biocompost from paddy and coffee husk wastes.
- To determine the microbial dynamics and physico-chemical transformations during composting.
- To interpret the surface morphological characteristics of raw and biocompost using FESEM.
- To evaluate the functional group of the raw sample and biocompost by FT-IR spectroscopy.
- To evaluate the efficiency of biocompost on the growth and yield parameters of the selected plants.
- To study the biochemical parameters such as chlorophyll, protein, carbohydrates (leaves and seeds) and leghaemoglobin content in root nodules of selected plants.
- To analyze the antioxidant and anti bacterial activity in the seed and leaf extracts of selected plants.
- To identify the phytochemical present in the methanol extracts of leaves and seeds of the best treatment in medicinal plants.
- To assess the initial and post – harvest soil analysis.

MATERIALS AND METHODS

The present study consists of the biocomposting of paddy and coffee husk using microbes such as *Pleurotus eous, Pleurotus florida, Trichoderma asperelloides* and earth worms *Eisenia fetida.* The work plan for the study consist of 4 phases.

PHASE - I

- Collection of Agro Industrial Wastes
- Collection of Microorganisms
- Collection of Earth worms
- Preparation of the Compost pit
- Vermicompost experimental tray preparation
- Microbial population during 20^{th}, 40^{th}, 60^{th} & 80^{th} days of composting process
- Morphological study of the raw and compost samples by using Field Emission Scanning Electron Microscope (FESEM) and Fourier Transform Infrared (FTIR) spectroscopy.
- Physico - chemical parameters of raw and composted paddy and coffee husk

The pH and Electrical conductivity of raw and composted wastes were analyzed by using digital pH meter and EC meter.

1. Lignin (%)
2. Cellulose (%)
3. Organic carbon (%)
4. Total Nitrogen (%)
5. Total Phosphorus (%)
6. Total Potassium (%)
7. Calcium and magnesium (%)

PHASE - II

- **Cultivation of the selected plants**
  1. Collection of seeds
  2. Pot culture experiment
- **Evaluation of Biometric parameters of the test plants**

Biometric parameters of test plants root length (cm), shoot length (cm), number of leaves, number of nodules, plant fresh weight (g), plant dry weight (g) for moth bean, black gram, fenugreek on 20, 40 and 60 DAS and Kalmegh on 30, 60 and 90 DAS were recorded.

- **Evaluation of the yield parameters of the test plants**

The yield parameters of the test plants including number of pods per plant, number of seeds per pod, length of the pod (cm), weight of the pod (g), weight of the seeds per pod (g), fresh weight of the pod (g), dry weight of the pod (g) were recorded on 90^{th} day (moth bean, black gram and fenugreek) and 120^{th} day (kalmegh) plants.

- **Authentication of test plants**

All the selected plants were prepared as herbarium and were identified by Botanical Survey of India, Deccan regional center, Hyderabad.

PHASE -III

- **Biochemical Analysis of test plants**

1. Estimation of Protein and Carbohydrate in leaves and seeds (mg/g)
2. Estimation of Chlorophyll in leaves (mg/g)

3. Estimation of Leghaemoglobin content in nodules (mg/g)
4. Preliminary phytochemical Assessment (Medicinal Plants)

The active secondary metabolites present in methanol leaf extracts of *Andrographis paniculata* (Burm.f)Wall.ex Nees and the seeds of *Trigonella foenum-graecum* L. were determined using the standard techniques.

PHASE - IV

- **Analysis of Antioxidant Activity of test plants (Best treatment)**

Antioxidant activity was performed using the assays on under the best treatment (T_6) and control grown test plants seeds (Moth bean, Black gram and Fenugreek) and leaves (Kalmegh). The ability of test plants aqueous and methanol seed and leaf extracts to scavenge free radical was assessed by

1. Hydrogen peroxide scavenging activity
2. Nitric oxide radical scavenging activity
3. Reducing power assay
4. DPPH radical scavenging activity

- **Antibacterial activity**

- **Experimental pre and post-harvest soil analysis**

1. pH and EC
2. Available nitrogen
3. Available phosphorus
4. Available potassium

Statistical Analysis of the Data

The obtained data of the microbial population during biocomposting, vegetative and biochemical parameters for moth bean, black gram, fenugreek on 20, 40, 60 DAS and 30, 60 and 90 DAS for kalmegh, yield parameters on 90 DAS (moth bean, black gram and fenugreek) and 120 DAS (kalmegh) antioxidant and antibacterial activity of the seed extracts of the best treatment and control plants were subjected to SPSS (Version Sigma stat 3.1) statistical analysis of variance (One -way and Two - way ANOVA) and conclusions were drawn based on the results.

RESULTS

PHASE – I

Collection of Agro Industrial Wastes

The agro industrial wastes paddy husk was collected from nearby villages in Visakhapatnam District of Andhra Pradesh. The coffee husk was collected from Araku valley, a hill station in Alluri Sitha Ramaraju District, Andhra Pradesh. The collected raw samples were sun dried completely and preserved for the further study.

Collection of Microorganisms

The microorganisms *Pleurotus eous*, *Pleurotus florida* and *Trichoderma asperelloides* for the biocomposting process were collected from Tamil Nadu Agricultural University, Coimbatore.

Collection of Earth worms

The earth worms *Eisenia fetida* were collected from regional Agricultural research station, Acharya N.G Ranga Agricultural University, Anakapalli, Andhra Pradesh.

Preparation of the Compost pit

The raw samples of paddy and coffee husks were partially decomposed by using pit composting method in six pits, each with the measurement of 4 square feet width and 2.5 feet height.

Vermicompost experimental tray preparation

Plastic trays of 40 x 20 x 15cm were used for the experiment with proper draining system. After 30 days, the preprocessed coffee husk and paddy husk were filled in separate plastic trays (C_1, C_2, C_3, C_4, C_5 & C_6).

Microbial population

Total microbial populations of bacteria, fungi and actinobacteria in the 6 compost piles indicated significant variations in relation to temperature changes during composting process. Mesophilic phase or during moderate temperature phase it showed moderate populations and increased microbial populations were observed in thermophilic phase. The maximum increase was noted in C6 (Raw coffee husk + 6.5g *Pleurotus eous*, 6.5g *Pleurotus florida*, 7g *Trichoderma asperelloides* + *Eisenia fetida* 5t/ha) followed by C3 (Raw paddy husk + 6.5g *Pleurotus eous*, 6.5g *Pleurotus florida*, *7*g *Trichoderma*

asperelloides + *Eisenia fetida* 5t/ha) from 20 Days to 60 days and then slightly declined on 90th day (Maturation phase).

Composting

Morphological and physico-chemical composition analysis of the raw and biocomposts of paddy and coffee husks

The morphology of raw and biocomposts observed with Fourier transform infrared (FT-IR) spectroscopy and Field Emission scanning electron Microscopy (FESEM). The study of this characterization revealed that the presence of functional groups, better resolutions and vibrational C-O and C-H stretches were observed. Significant disappearance of these functional groups was recorded in biocompost C6 followed by C3.

The micrographs of FESEM have revealed the surface level changes of before and after composting of paddy and coffee husk. Among all the treatments C6 revealed greater surface changes which resulted in porous, more fragmented texture followed by C3 this is because of active microbial degradation of organic matter and maximum accumulation of minerals in the biocompost. The techniques used in the morphological study revealed about the maturity and stability of biocomposts.

Physico–chemical parameters clearly defined the compost maturity. Among all the 6 different compost treatments, biocompost C6 found to be efficient, due to significant reduction in lignin, cellulose, C:N ratio, organic carbon, EC and significant increase in nitrogen, potassium, calcium and magnesium followed by C3 in comparison to other treatments and raw samples of paddy and coffee husk.

PHASE - II

Collection of seeds

Seeds of moth bean were collected from Rajasthan Agriculture Institute, Jaipur, black gram from Tamil Nadu Agriculture University, Coimbatore, fenugreek from N.G Ranga Agicultural University, Guntur and Kalmegh from CIMAP, Hyderabad, Telangana.

Pot Culture Experiments

Biocomposted paddy husk and coffee husk were incorporated into different treatments and used for pot culture experiments are as follows.

Treatment Code	Treatments Composition	Biocompost
C	Control (without treatment)	Control
T_1	Raw paddy husk + 20g *Pleurotus eous* + *Eisenia fetida* (5t/ha)	Biocompost - 1
T_2	Raw paddy husk + 20g *Pleurotus florida* + *Eisenia fetida* (5t/ha)	Biocompost - 2
T_3	Raw paddy husk + 6.5g *Pleurotus eous* + 6.5g *Pleurotus florida* + 7g *Trichoderma asperelloides* + *Eisenia fetida* (5t/ha)	Biocompost - 3
T_4	Raw coffee husk + 20g *Pleurotus eous* + *Eisenia fetida* (5t/ha)	Biocompost - 4
T_5	Raw coffee husk + 20g *Pleurotus florida* + *Eisenia fetida* (5t/ha)	Biocompost - 5
T_6	Raw coffee husk + 6.5g *Pleurotus eous* + 6.5g *Pleurotus florida* + 7g *Trichoderma asperelloides* + *Eisenia fetida* (5t/ha)	Biocompost - 6

Biometric characters

To study the efficiency of agroindustrial wastes paddy and coffee husk as organic manure on the growth of some selected plants. The pot culture experiments were conducted with moth bean (*Vigna aconitifolia* (Jacq) Marechal) Var. RMO- 40, black gram (*Vigna mungo* (L.) Hepper) Var. CO- 6, fenugreek (*Trigonella foenum-graecum* L.) Var. Lam Selection -1 on 20, 40, 60 DAS and kalmegh (*Andrographis paniculata* (Burm.f.) Wall.ex Nees) Var. CIM - Megha on 30, 60 and 90 DAS.

Moth bean (*Vigna aconitifolia* (Jacq) Marechal) Var. RMO- 40

Pot culture experiments of Moth bean showed maximum biometric parameters of root length (cm), shoot length (cm), number of leaves, number of nodules, plant fresh weight (g), plant dry weight (g) in T6, T3 and T5 on 20, 40, 60 DAS followed by other treatments and control.

Black gram (*Vigna mungo* (L.) Hepper) Var. CO- 6

Black gram showed remarkable increase in root length, shoot length, number of leaves, plant fresh weight, dry weight and number of nodules were observed in T6 followed by T3 on 20, 40 and 60 DAS when compared to the other treatments and control.

Fenugreek (*Trigonella foenum-graecum* L.) Var. Lam Selection -1

The treatment 6 (T6) showed increased root length, shoot length, number of leaves, plant fresh weight, dry weight and number of nodules on all the three days examined (20, 40 and 60 DAS) as compared to control and other treatments.

Kalmegh (*Andrographis paniculata* (Burm.f.) Wall.ex Nees) Var. CIM- Megha

Maximum root length, shoot length, number of leaves/plant, fresh weight and dry weight of the plant was noted in treatment T6 (Raw coffee husk + 6.5g *Pleurotus eous* + 6.5g *Pleurotus florida* + 7g *Trichoderma asperelloides* + *Eisenia fetida* (5t/ha) followed by T3 (Raw paddy husk + 6.5g *Pleurotus eous* + 6.5g *Pleurotus florida* + 7g *Trichoderma asperelloides* + *Eisenia fetida* (5t/ha) on 30, 60 and 90 DAS as compared to other treatments and control.

Yield Parameters

The yield parameters of the test plants moth bean, black gram and fenugreek showed maximum number of pods per plant, number of seeds per pod, length of the pod (cm), weight of the pod (g), weight of the seeds per pod (g), fresh weight of the pod (g), dry weight of the pod (g) were recorded in T6 followed by T3 on 90^{th} day and medicinal plant kalmegh also showed similar results on 120 DAS.

The results of phase - II confirmed that vegetative and yield parameters showed positive result and it is due to the application of biocomposts T6 and T3 which acted as enriching agents to the soil as well as boosted the plant growth and also improved the plant building structures.

PHASE - III

Biochemical Analysis

Among all the treatments, T6 showed the maximum protein, carbohydrate, chlorophyll ‘a’, ‘b’ and total chlorophyll content in the leaves of moth bean, black gram, fenugreek (20, 40, 60 DAS) and kalmegh on 30, 60, 90 DAS. Maximum

leghaemoglobin content in the root nodules was also noted maximum in T6 followed by T3 as compared to other treatments and control.

Protein and carbohydrate content in the seeds of moth bean, black gram, fenugreek (90 DAS) and kalmegh (120 DAS) was noted maximum in T6 and T3 as compared to the control and other treatments. The increase in the biochemical content might be due to the application of biocomposts which enhances physiological and metabolic activities in the plant tissue. As a consequence of this, there was an increase in nitrogen uptake from the soil and it further assimilates the protein and carbohydrate biosynthesis.

Phytochemical Analysis

Medicinal plants are rich source of bioactive phytochemicals as they are natural compounds and potentially provide health benefits however fenugreek and kalmegh are popular from centuries for their medicinal value. Phytochemical screening of plants grown under the best treatment T6 fenugreek (seed extract) and kalmegh (leaf extract) in methanol revealed the presence of enormous phytochemicals such as alkaloids, flavonoids, sterols, anthraquinone, carbohydrates, saponins, cardiac glycosides, glycosides, terpenoids and phenolic compounds.

PHASE – IV

Antioxidant and antibacterial activity

Results of the above mentioned experiments showed among all the treatments T6 was found to be more influential and effective biocompost as compared to other treatments and control. Therefore, the antioxidant and antibacterial activity was carried out in treatment T6 (best treatment) and control with aqueous and methanol seed extracts of moth bean, black gram, fenugreek and kalmegh (leaves).

Antioxidant activity

Antioxidant activity of the selected plant seed samples was analyzed for free radical scavenging assays (hydrogen peroxide scavenging activity, nitric oxide radical scavenging activity, reducing power assay and DPPH radical scavenging activity) of different extracts. By comparing the aqueous and methanol extracts of the four plants, promising antioxidant activity was shown in methanol seed extracts of fenugreek followed by kalmegh in the best treatment (T6) - (Raw Coffee husk + 6.5g *Pleurotus eous,* 6.5g

Pleurotus florida, 7g *Trichoderma asperelloides* + *Eisenia fetida* (5t/ha) as compared to control and standard ascorbic acid.

Antibacterial activity

Antibacterial activity of moth bean, black gram, fenugreek and kalmegh was carried out with the seeds of best treatment (T6) and control. Aqueous and methanol extracts were examined against gram positive (*Staphylococcus aureus*) and gram negative bacterial species (*Escherichia coli* and *Vibrio cholerae*). Both the extracts showed antibacterial activity in all the plants. Among the two extracts, methanol extracts of fenugreek and kalmegh showed highest zone of inhibition against *Vibrio cholerae* and *Escherichia coli* followed by aqueous extract. The zone of inhibitions was moderately different from each other as compared to the standard antibiotic Streptomycin.

Pre and Post harvest Soil Status

Initial nutrient status in soil

The results revealed that soil pH, electrical conductivity (dSm^{-1}), available nitrogen (kg/ha), phosphorus (kg/ha) and potassium (kg/ha) were found to be more in T6 treatment as compared to control.

Post harvest nutrient status in soil

Maximum improvement in pH, electrical conductivity, available nitrogen (kg/ha), phosphorus (kg/ha) and potassium (kg/ha) were found in T6 biocompost as compared to control in post harvest soil of moth bean, black gram, fenugreek and kalmegh.

PUBLICATIONS

- **Hema, S**., Vijayalakshmi, A., & Silpa, M. (2022). Impact of paddy and coffee husk as the bio compost and its effect on the growth and yield of black gram [*Vigna mungo* (L.) Hepper]. *Agricultural Science Digest*, *44*(1), 184-188.

- **Hema, S**., Vijayalakshmi, A., & Raihing, P. (2022). The effect of paddy and coffee husk as the organic manure on the vegetative and yield parameters of moth bean [*Vigna aconitifolia* (Jacq) Marechal]. *Agricultural Science Digest*, *44*(2), 260- 264.

CONCLUSION

The findings of the present study demonstrate the positive effect of paddy and coffee husk biocompost on enhancing the crop productivity and soil nutrition. Biocomposted paddy and coffee husk produced by the degradation of ligno - cellulolytic fungi (*Pleurotus eous, Pleurotus florida* and *Trichoderma asperelloides*) and earthworm *Eisenia fetida* was found to be an efficient organic manure. Application of this vermicompost has rejuvenated the depleted soil fertility, enriched the available pool of nutrients, maintained the soil quality and conserved more water and biological resources. The study also proved that vermicompost to be a miraculous plant growth stimulator with the supply of plant nutrients.

The present work is not only an alternate solution for the disposal of agro industrial wastes like paddy and coffee husk but it minimizes and reduces the application of excess amount of chemical fertilizer that leads to degradation of soil health and causing environmental pollution. The process of biocomposting is also easy to operate and can be successfully prepared by unskilled small and marginal farmers. Amidst all the environmental pollution and increasing food demand, biocompost can be a solution. In future, there will be a tendency of adopting biocompost by farmers and others. The potentiality of biocompost is still not fully exploited yet. Hence, there is a need to appoint more extension workers to educate the farmers about vermicomposting and its benefits for achieving sustainability. Biocomposting is more economical than synthetic organic fertilizer. So, economic viability, environmental stability and enhancing livelihood quality are the major causes for its worldwide adoption in food production.

The present study confirmed that the application of paddy and coffee husk biocompost (T6 and T3) enhanced the biometric, biochemical, yield parameters, antioxidant, antibacterial and phytochemical of the test plants moth bean, black gram, fenugreek, kalmegh and soil fertility when compared to other treatments and control due to the improved nutritional, physical, chemical and biological properties of the biocompost. Therefore, the nutrient rich profile of paddy and coffee husk biocompost, proved its appropriateness for agricultural application. Hence, it can be stated that vermicomposted paddy and coffee husk has immense potential for recycling and recovery of plant nutrients from agro industrial wastes.

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